Negative E in momentum classes

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The problem

- We have to deal with E<0 4-momentum
  - Because CaloCell can have E<0
  - Every studies/calibrations have been done using E<0 cells
- Different conventions used across the code base
  - E<0 => pt()<0 , example : P4PxPyPzE
  - E<0 => pt()>0, example : P4ImplPxPyPzE

Consequences

- Many functions react differently according to which class they belong :
  - cosPhi(), sinPhi() (→ 3-momentum can be flipped)
  - px(), py(), p()
  - What about HepLorentzVector, TlorentzVector ?
- Conversion between classes adds confusion
  - P4ImplEEtaPhiM ↔ PxPyPzE ?
- Difficulties when **adding** 4moms
- fixed bugs can reappear when changing base class

Solution ?

- Can not forbid E<0
- We agree on a convention for kinematics with E<0
- Revise ALL kinematic base class
- Implement correct algebra (addition, conversions)
- Rely on this algebra (not on HepLorentzVector's)
  - Means checking every clients of base classes
- Other ?

Unrelated : TruthParticlee

- We need TruthParticles compatible with Pile-up event !!
- Currently missing an extended barcode to account for multiple MCEvent collections
- We have REAL pile-up, this is **URGENT**, specially for jets.